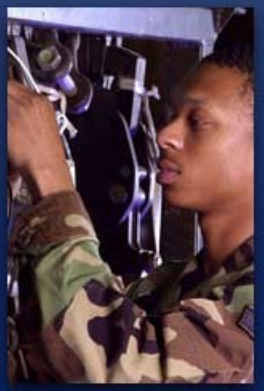
AFOTEC

AIR FORCE OPERATIONAL TEST AND EVALUATION CENTER



A Structured Means for Early Estimation of Test Resources

Major Michael Rehg
LtCol Kevin Moore
HQ AFOTEC / ASE
4 March 2004

Introduction

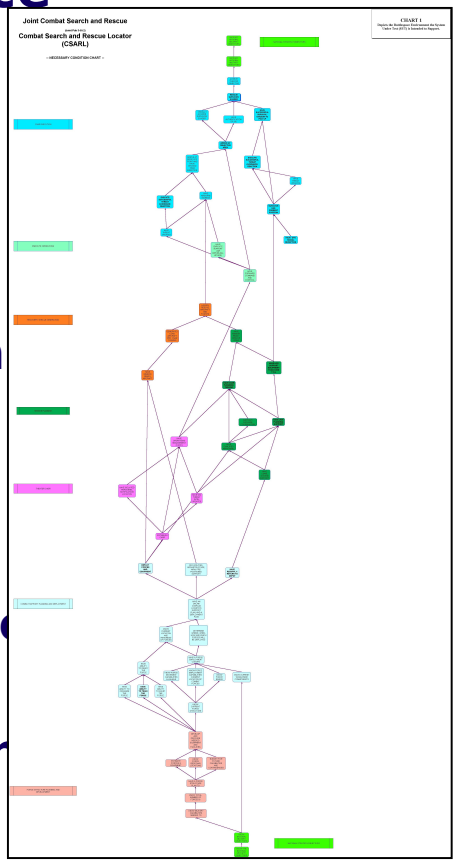
- Problem Statement
- Purpose of the NCC
- Description of the NCC
- Depicting the battlespace
- Initial test design
- Conclusions

The Problem

- Defining the scope and estimating resources needed for a future test
- Inadequate source documentation
  - Requirements documents – may be incomplete, vague
  - Acquisition documents – high level, programmatic in nature
- Where does a test team begin in the process?
- How does a test team ensure they have captured the scope of the test?

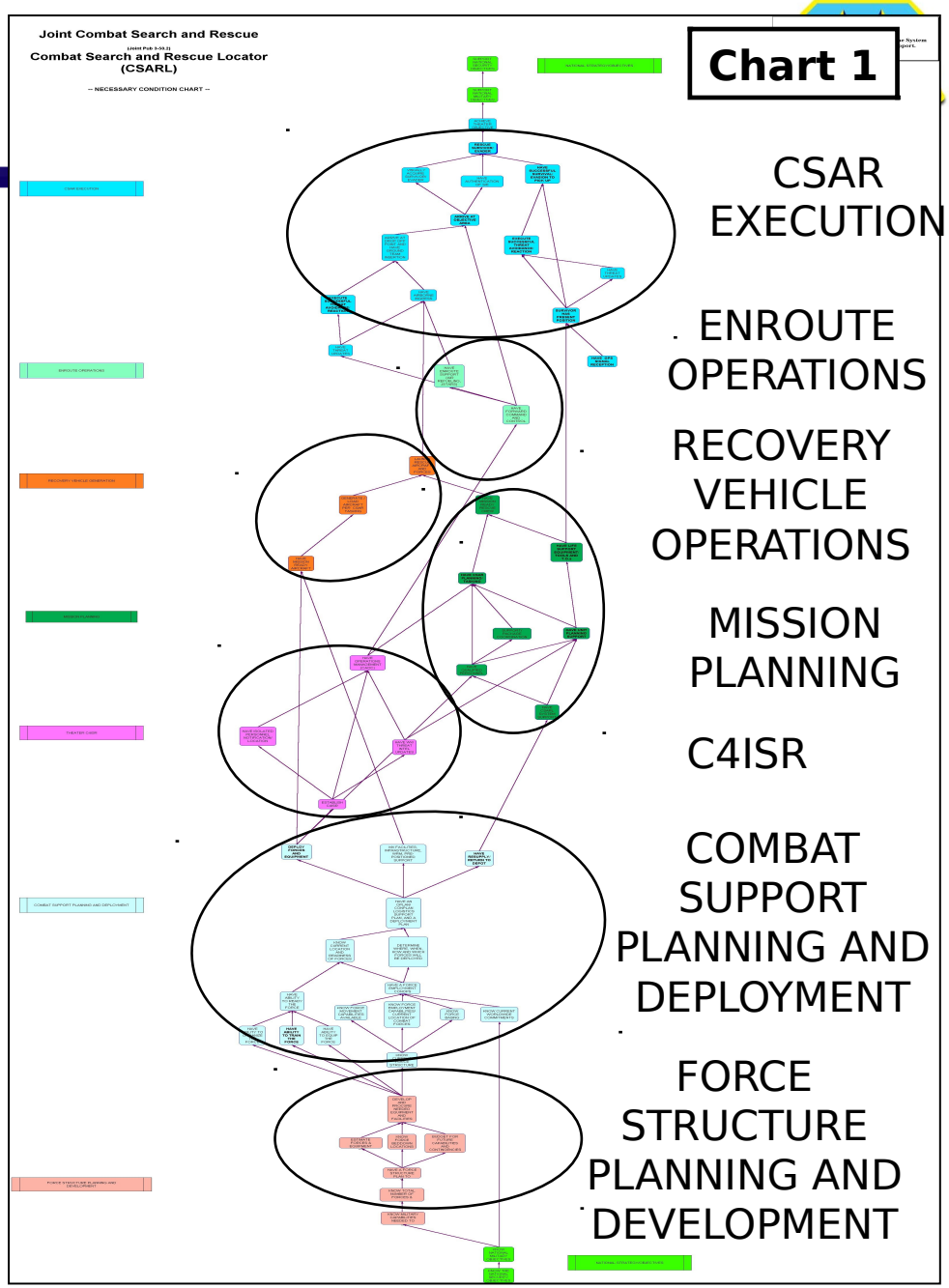
Purpose of the NCC

- NCC is tool used to develop the battlespace
- Describes Battlespace Environment the system is intended to support from a 'system of systems' perspective
  - Derived by multi-organizational team
  - Joint and Air Force Doctrine provide common terms, definitions, and understanding
  - Identifies common relationship between requirements and operational impact
  - Critical areas of the operation effected by the SUT
- Increases value of OT&E information for the warfighter in terms they understand



JOINT COMBAT SEARCH AND RESCUE

- **Battlespace Environment depicted**
  - **Major Phases are logical groupings of the Primary Nodes**
  - **Primary Nodes are significant elements of the operation**
  - **Linking them as necessary conditions generates depiction**



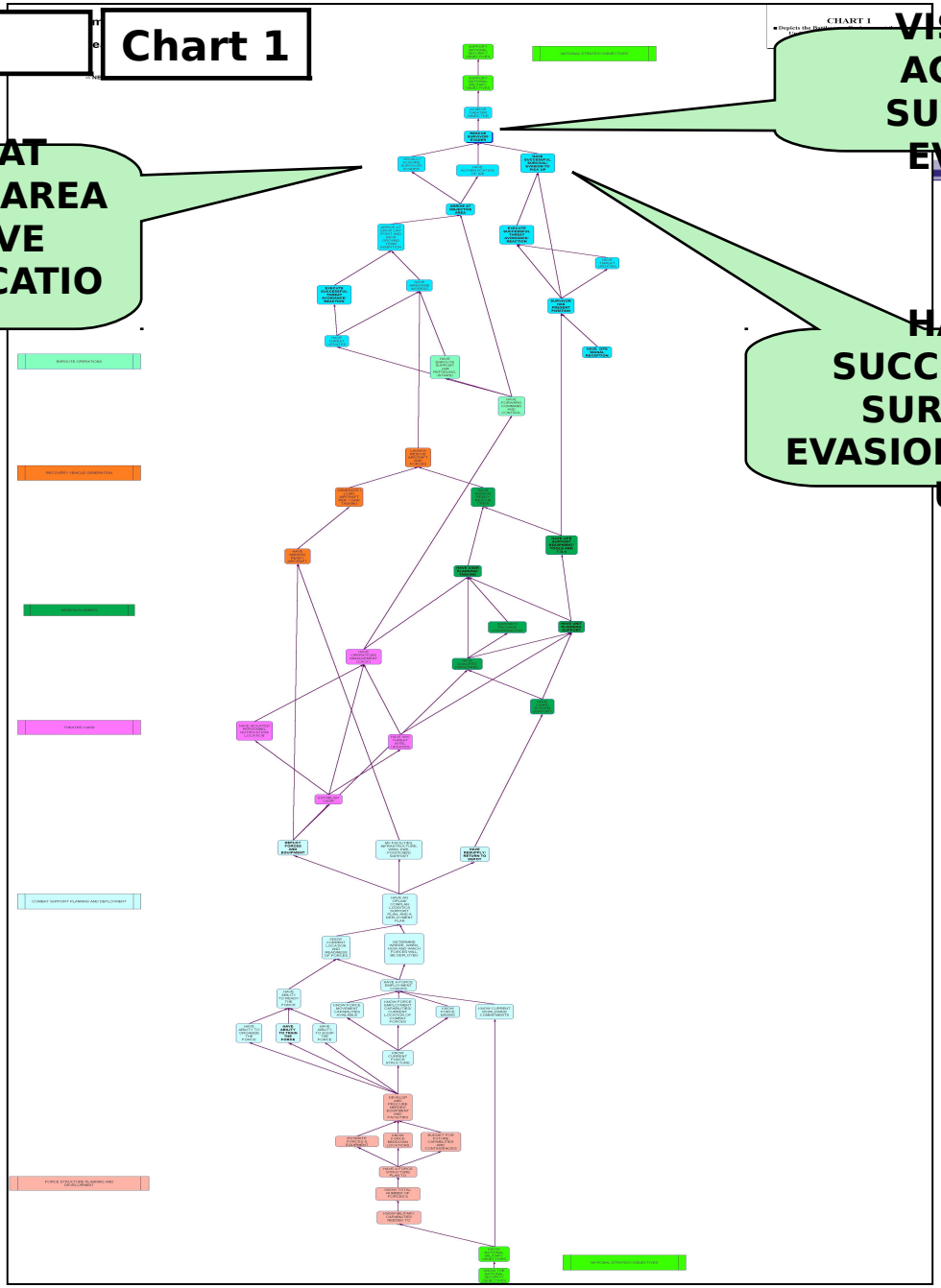
JOINT CSAR

Chart 1

VISUALLY ACQUIRE SURVIVOR EVADOR

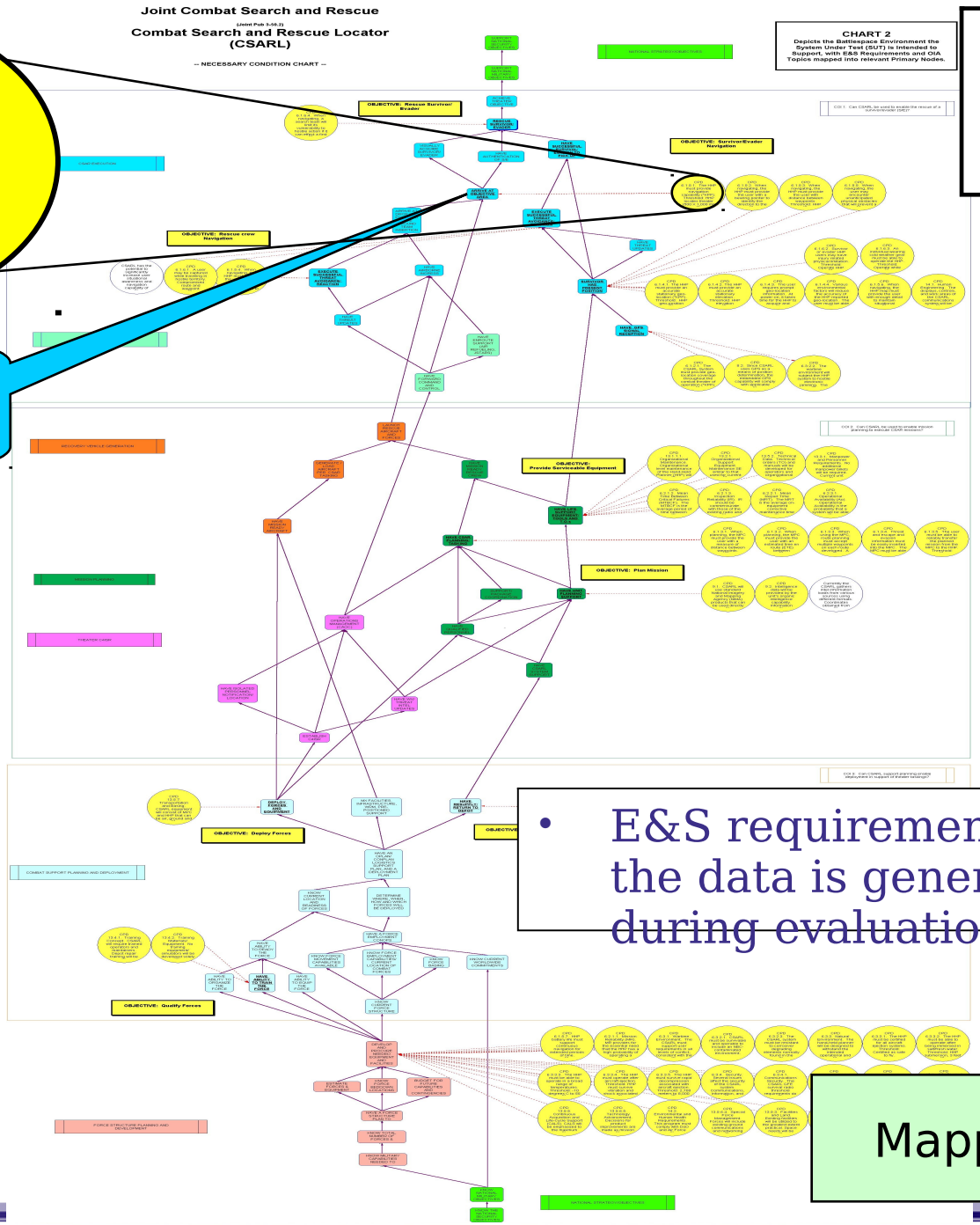
ARRIVE AT OBJECTIVE AREA AND HAVE AUTHENTICATION

HAVE SUCCESSFUL SURVIVAL EVASION TO PICK UP



The HHP must provide navigation capability *KPP

Arrive at Objective Area

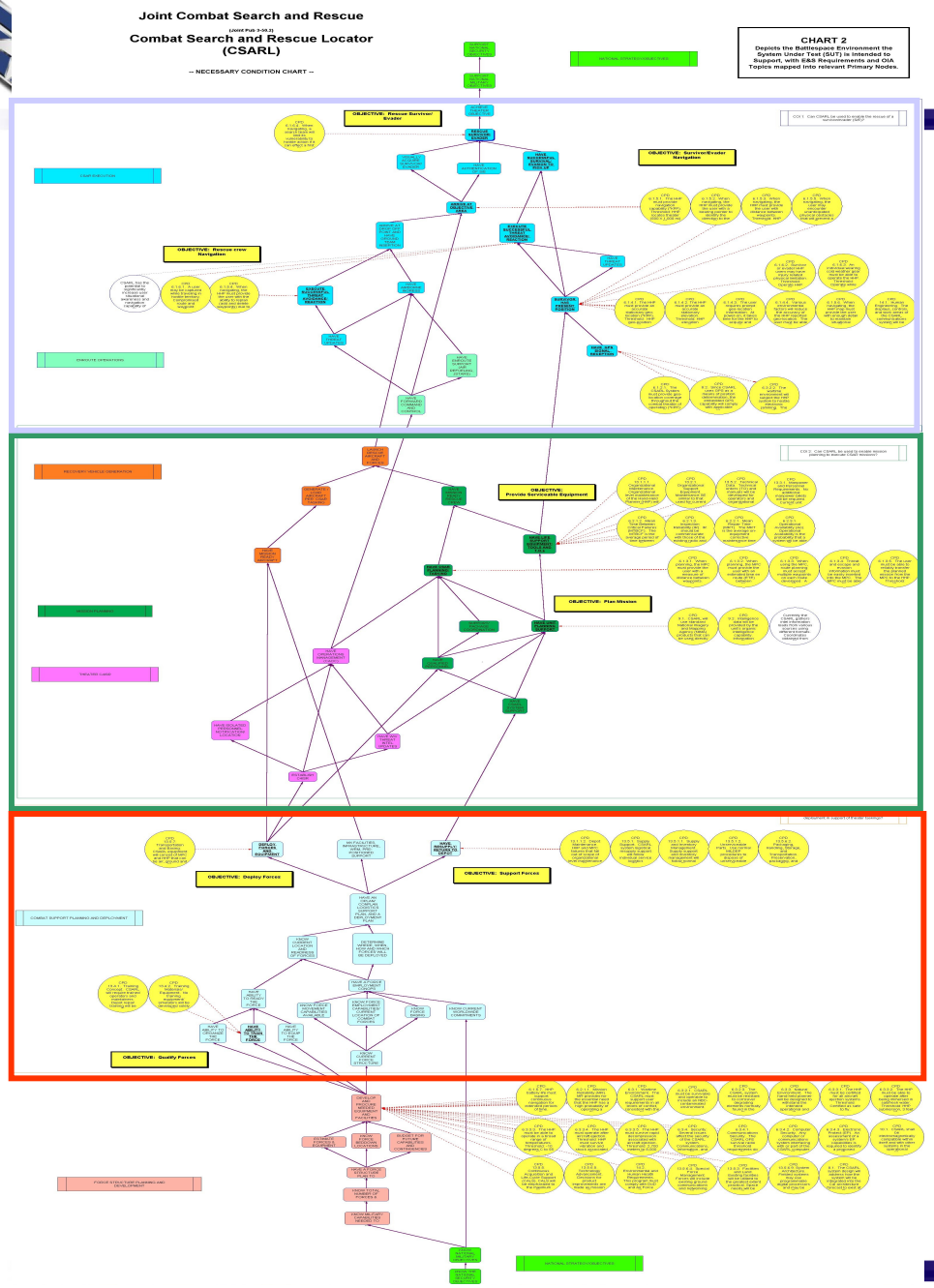

Joint Combat Search and Rescue
Combat Search and Rescue Locator (CSARL)
-- NECESSARY CONDITION CHART --
CHART 2
Depicts the Battlespace Environment the System Under Test (SUT) is Intended to Support, with E&S Requirements and CIA Topics mapped into relevant Primary Nodes.
OBJECTIVE: Rescue Survivor/ Evader
OBJECTIVE: Survivor/Evader Navigation
OBJECTIVE: Rescue crew Navigation
OBJECTIVE: Provide Serviceable Equipment
OBJECTIVE: Plan Mission
OBJECTIVE: Deploy Forces
OBJECTIVE: Qualify Forces

CSARL Chart 2

- E&S requirements - where the data is generated during evaluation

Mapping E&S

CSARL Chart 2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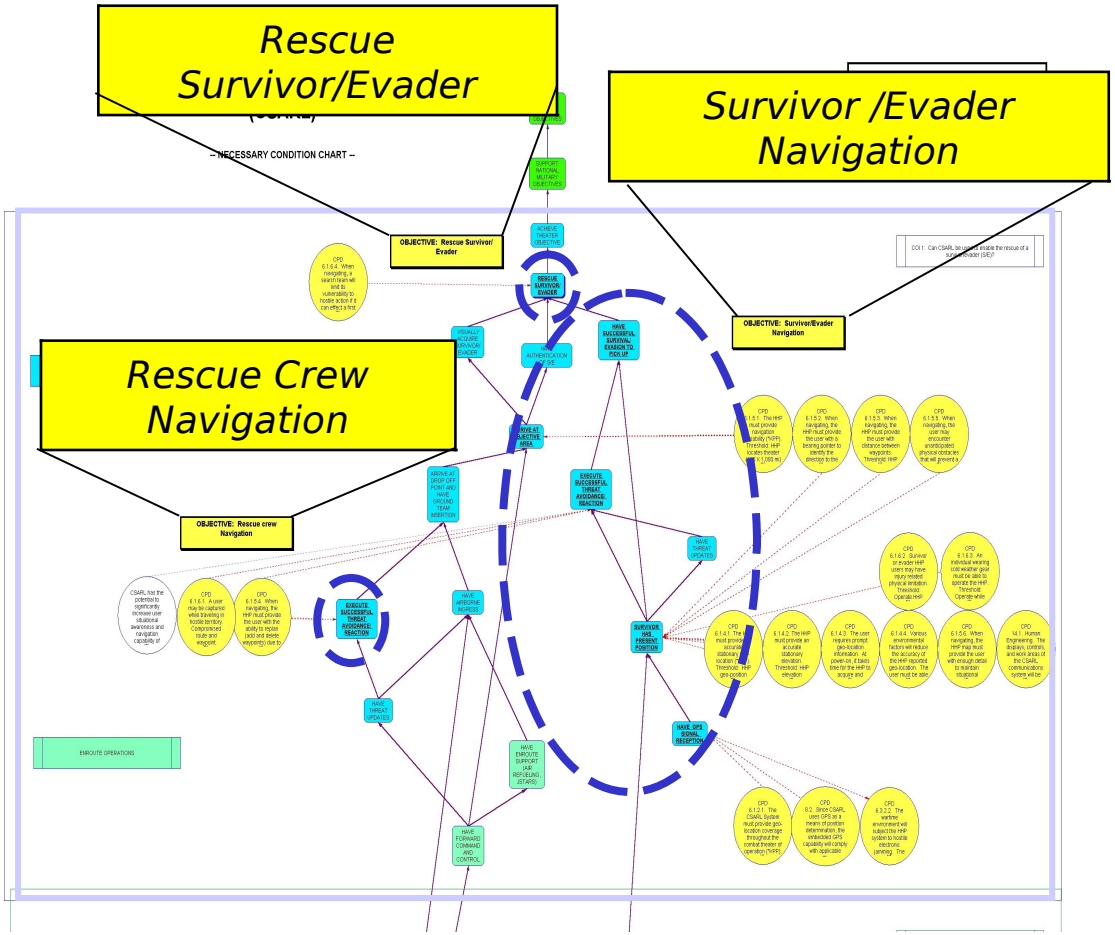
OBJECTIVE: Deploy Forces
OBJECTIVE: Support Forces
OBJECTIVE: Qualify Forces

- **Examine Major Phases and Primary Nodes with mapped operational requirements**
- **Form into logical groups**
- **Draft recommended COIs and Objectives**

Determining Evaluation Areas

Drafting COIs

Operational Objectives



- **Examine Evaluation Area with focus on**
  - **Primary nodes**
  - **Major Phases**
  - **Requirements**
- **Determine Operational**

Identifying Objectives

Operational Objective

- **Operational Objective: High level warfighter's mission/goals during a particular major phase that characterize a tangible component or aspect of the mission.**
  - **Can be a single node or compilation of nodes from the battlespace**
  - **Used to provide focus for the team to continue development of the operational environment.**

Developing Objectives

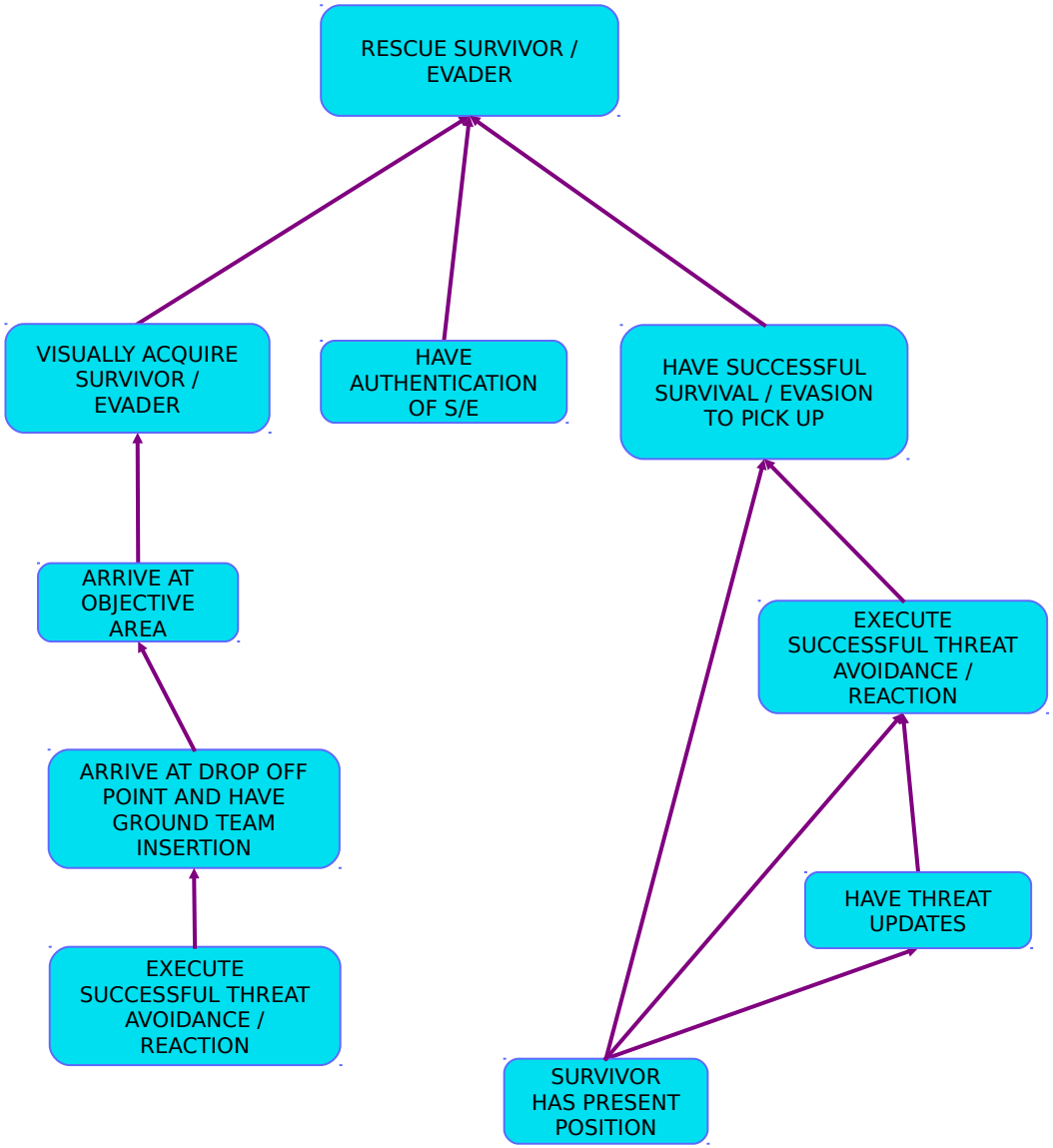
General rules for developing Operational Objectives

•Think from the perspective of the troop's in the seat, at the console, turning the wrenches, designing the system.

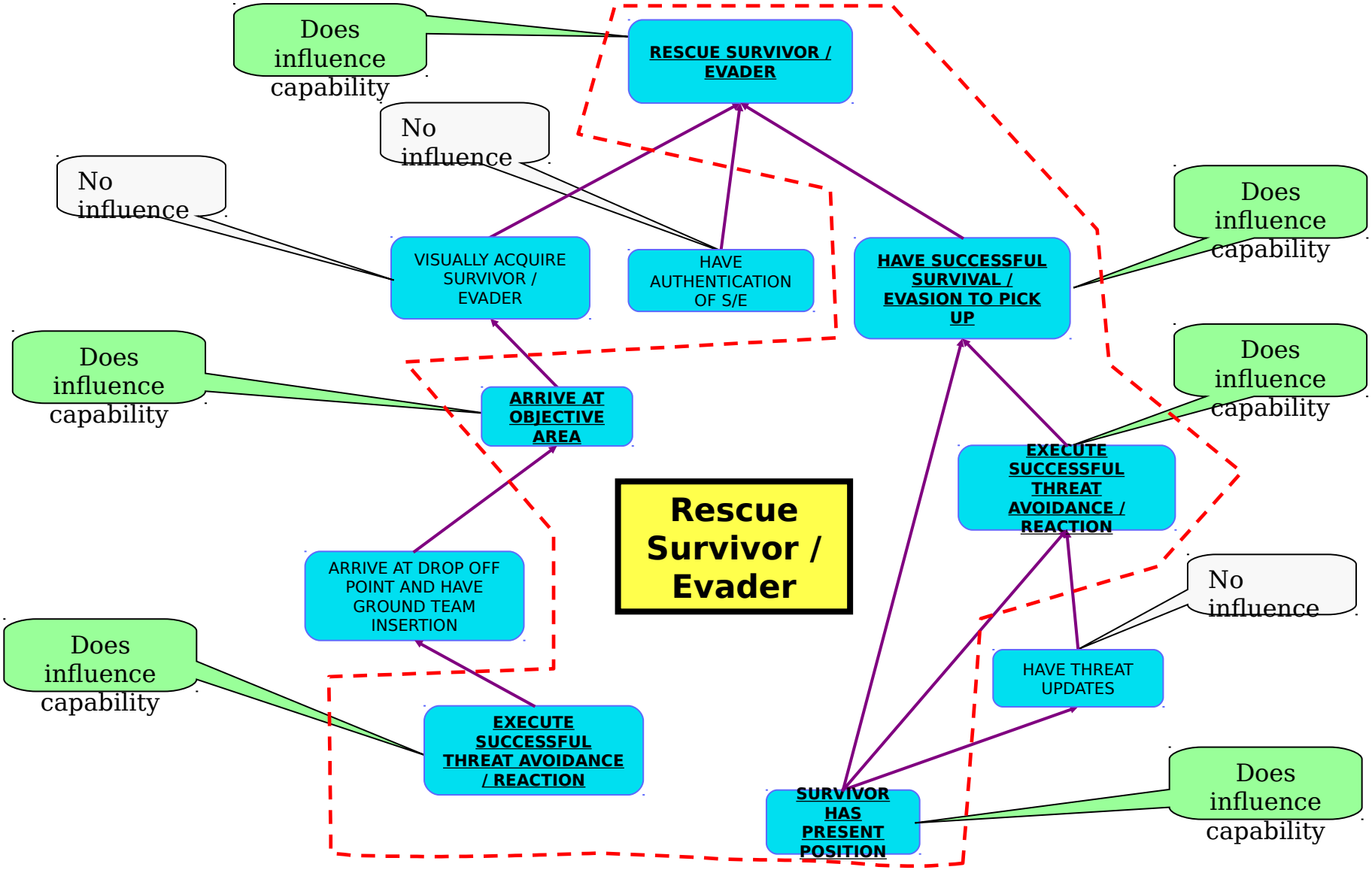
•Focus on the operation, but the system's influence on each piece of the operation must be considered.

• For each node ask, "What is the goal in this piece of the operation? What are the goals of the people employing in that part of the operation?

•The intent is not to design test for pieces of the operation where the system has no influence.


RESCUE SURVIVOR / EVADER
VISUALLY ACQUIRE SURVIVOR / EVADER
HAVE AUTHENTICATION OF S/E
HAVE SUCCESSFUL SURVIVAL / EVASION TO PICK UP
ARRIVE AT OBJECTIVE AREA
EXECUTE SUCCESSFUL THREAT AVOIDANCE / REACTION
ARRIVE AT DROP OFF POINT AND HAVE GROUND TEAM INSERTION
HAVE THREAT UPDATES
EXECUTE SUCCESSFUL THREAT AVOIDANCE / REACTION
SURVIVOR HAS PRESENT POSITION

Developing Objectives


Does influence capability
RESCUE SURVIVOR / EVADER
No influence
No influence
VISUALLY ACQUIRE SURVIVOR / EVADER
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Rescue Survivor / Evader
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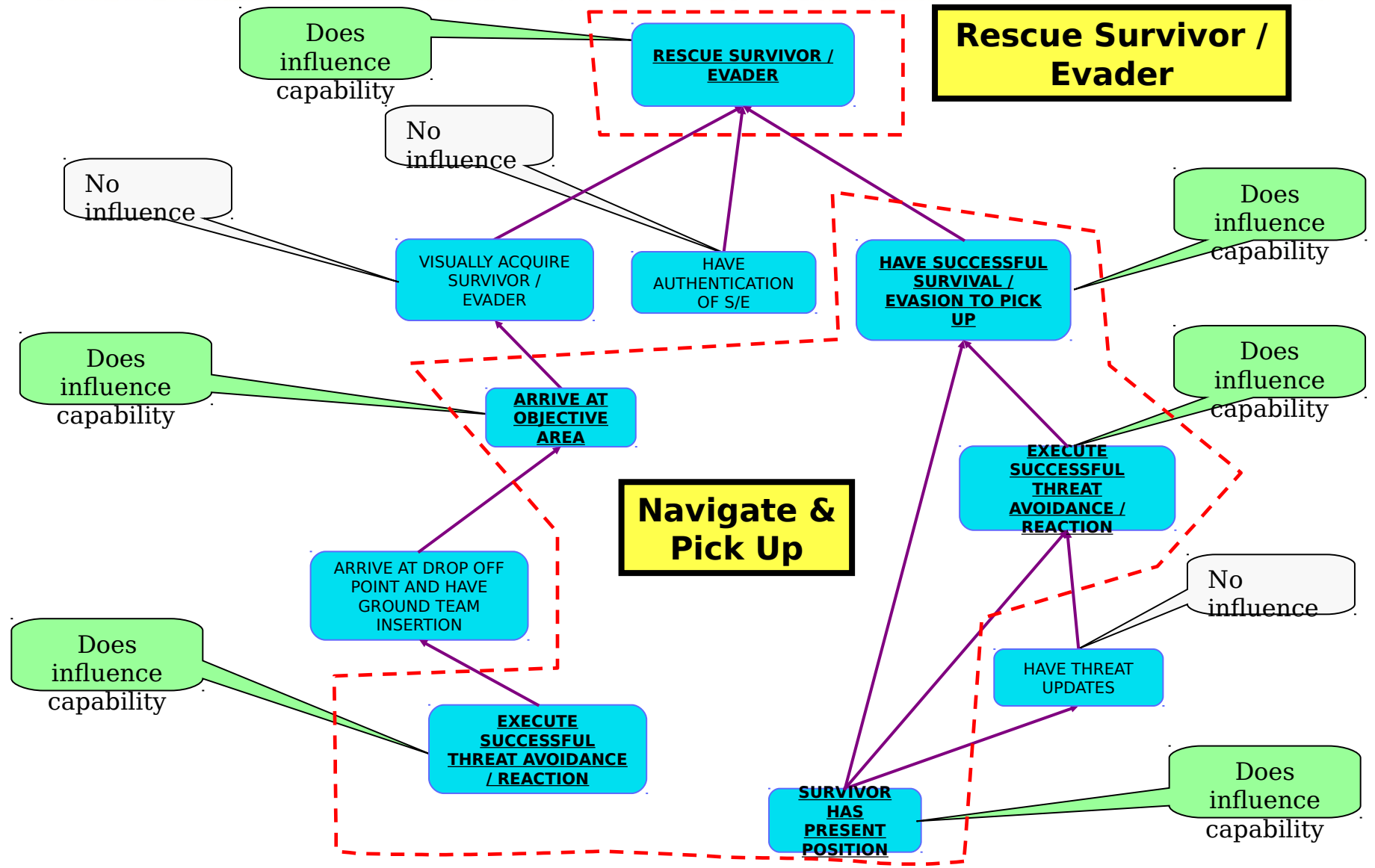
Developing Objectives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RESCUE SURVIVOR / EVADER
Does influence capability
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Does influence capability
ARRIVE AT OBJECTIVE AREA
Does influence capability
Navigate & Pick Up
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ARRIVE AT DROP OFF POINT AND HAVE GROUND TEAM INSERTION
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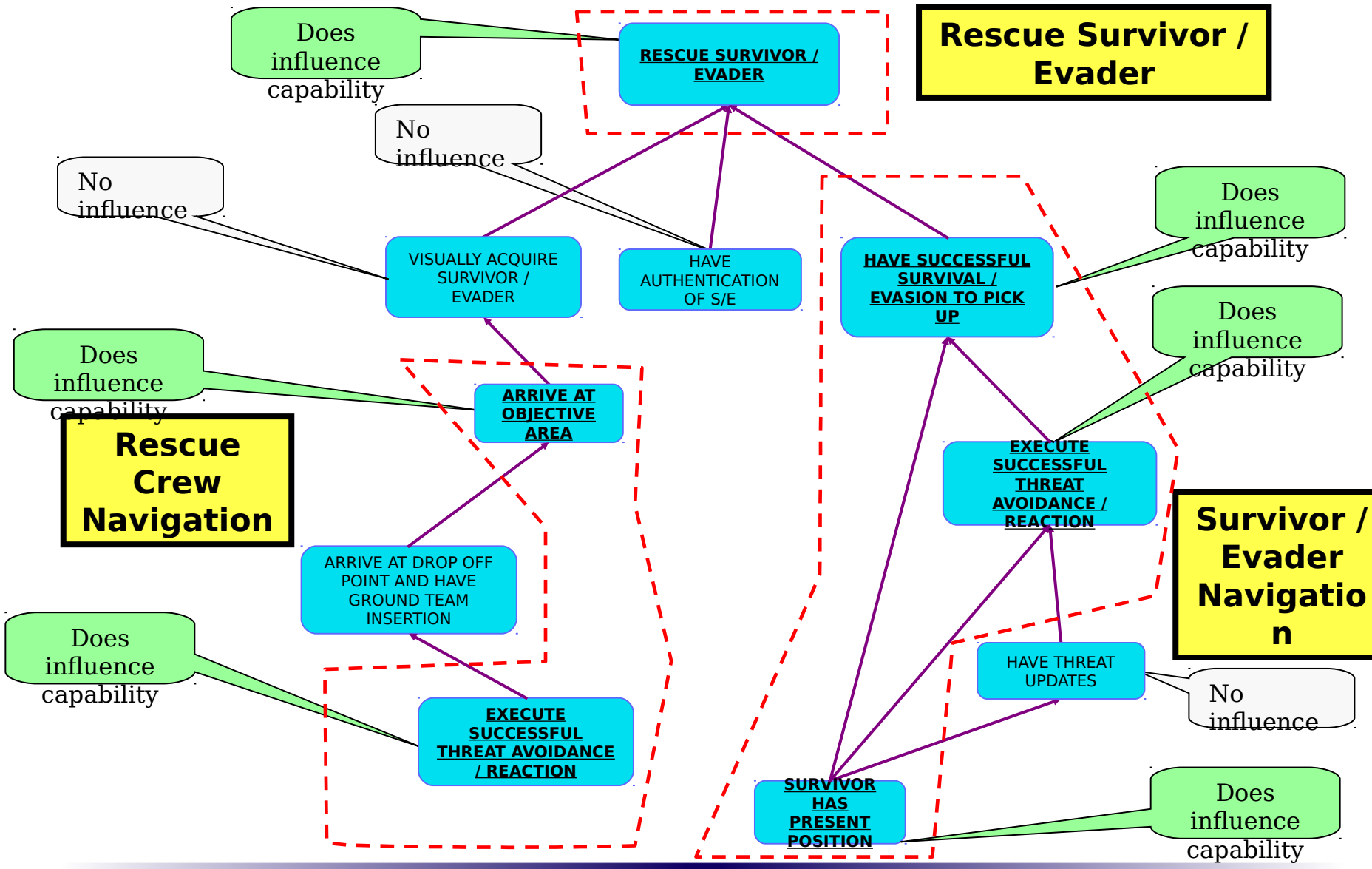
Developing Objectives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SURVIVOR HAS PRESENT POSITION
Does influence capability

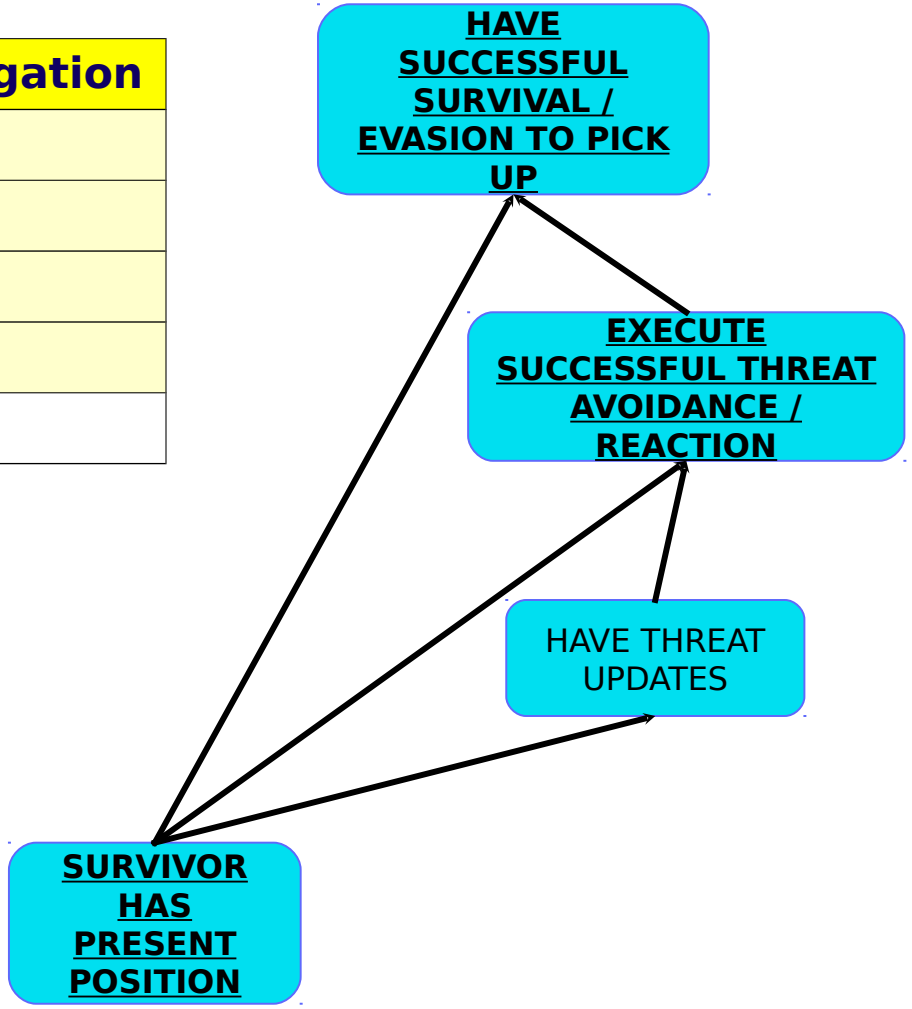
Operational Measure

- **<u>Operational Measure</u>: Warfighter's "measure of success" directly related to operational objective.**
  - **Identifies relevant operational aspects necessary for success of operational objective.**
  - **Ask the question: "How would the warfighter measure successful accomplishment of each objective?"**
- **Details or explanations can be captured in table notes**
- **Objectives and measures should provide linkage back to the primary COI.**

Measure Examples

Objective: Survivor / Evader Navigation
Accuracy of Geo-Position
Miss Distance from PUP
Accuracy of Navigation
Timeliness of Arrival
Notes:

Operational measures specifically address measuring successful completion of Objectives


HAVE SUCCESSFUL SURVIVAL / EVASION TO PICK UP
EXECUTE SUCCESSFUL THREAT AVOIDANCE / REACTION
HAVE THREAT UPDATES
SURVIVOR HAS PRESENT POSITION

Operational Factor

- **<u>Operational Factor</u>: Literal characterization of relevant battlespace conditions that can influence outcome of the operational objective…**
  - **Aspect (ex: environment) or component (ex: intel) of battlespace that asserts significant influence on operational objective –NOT SUT.**
  - **Prioritizing factor's effect on measures – based upon potential to effect performance of system if the factor levels change**

Defining Battlespace Conditions

Survivor/Evader Navigation - Operational Factors and Descriptors

Operational Factors	***Descriptors***			
Time of Day	Day	Night	Transistion	
Weather	Benign	Adverse		
Terrain	Mountain	Flat	Urban	Sea
Ground Cover	Jungle	Desert	Forest	
Threat	Low	High		
Mobility of S/E	None	Limited	Full	
Navigation Mode	Map	Compass	Mixed	

- Derived from Battlespace depiction
  - Significant elements of the operation, CONOP/CONEMP/CONEX
  - Requirements/Capabilities
  - AFTL (AFDD 1-1), UJTL (CJCSM 3500.04)
- Experience of Subject Matter Experts

Prioritizing Factors

Prioritization and Relationship of Factors to Measures

Factors	*Accuracy*	*Miss Dist*	*Nav Accuracy*	*Delta ETA*	*Factor Mgt*
Time of Day	L	L	L	L	Fix (Day)
Weather	L	L	L	L	Log
Terrain	H	H	H	L	Vary (3)
Ground Cover	H	H	H	M	Vary (3)
Threat	-	-	-	H	Vary (2)
Mobility of S/E	-	-	-	H	Fix (full)
Navigation Mode	L	H	H	-	Fix (mixed)

Number of test events = 2 x 3 x 3 = 18 events, plus excursions

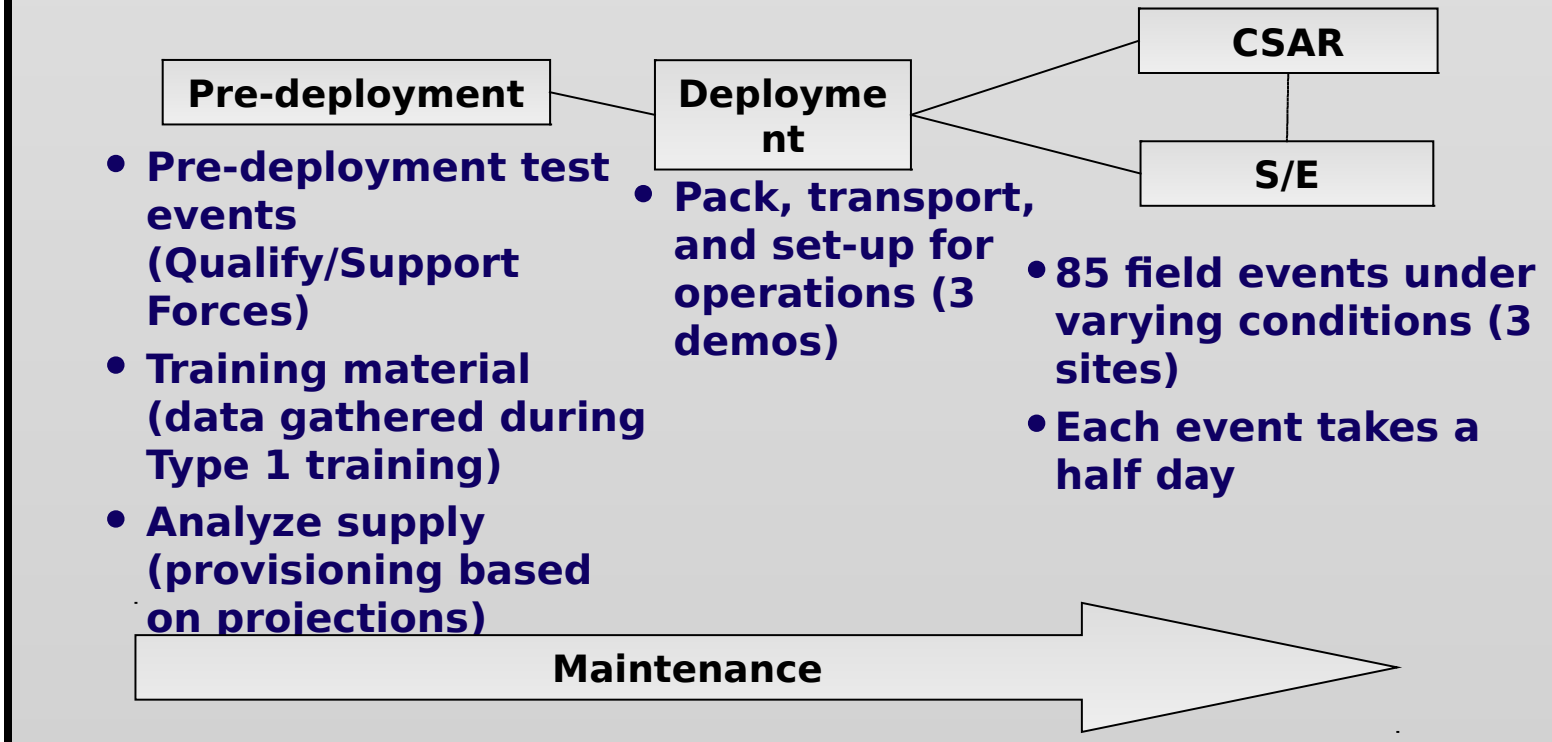
- Priority is based on:
  - Likelihood of influence/ amount of effect each factor has on system under test
  - Third-party interest (user, Congress, etc.)
- Supports effective management of constraints

Outcome – Initial Matrix

Test Event #	Terrain	Ground Cover	Threats	Nav Mode	Mobility of S/E	TOD	Weather
1	Mountain	Jungle	Low	Mixed	Full	day	logged
2	Mountain	Jungle	High	Mixed	Full	day	logged
3	Mountain	Desert	Low	Mixed	Full	day	logged
4	Mountain	Desert	High	Mixed	Full	day	logged
5	Mountain	Forest	Low	Mixed	Full	day	logged
6	Mountain	Forest	High	Mixed	Full	day	logged
7	Flat	Jungle	Low	Mixed	Full	day	logged
8	Flat	Jungle	High	Mixed	Full	day	logged
9	Flat	Desert	Low	Mixed	Full	day	logged
10	Flat	Desert	High	Mixed	Full	day	logged
11	Flat	Forest	Low	Mixed	Full	day	logged
12	Flat	Forest	High	Mixed	Full	day	logged
13	Urban	Jungle	Low	Mixed	Full	day	logged
14	Urban	Jungle	High	Mixed	Full	day	logged
15	Urban	Desert	Low	Mixed	Full	day	logged
16	Urban	Desert	High	Mixed	Full	day	logged
17	Urban	Forest	Low	Mixed	Full	day	logged
18	Urban	Forest	High	Mixed	Full	day	logged

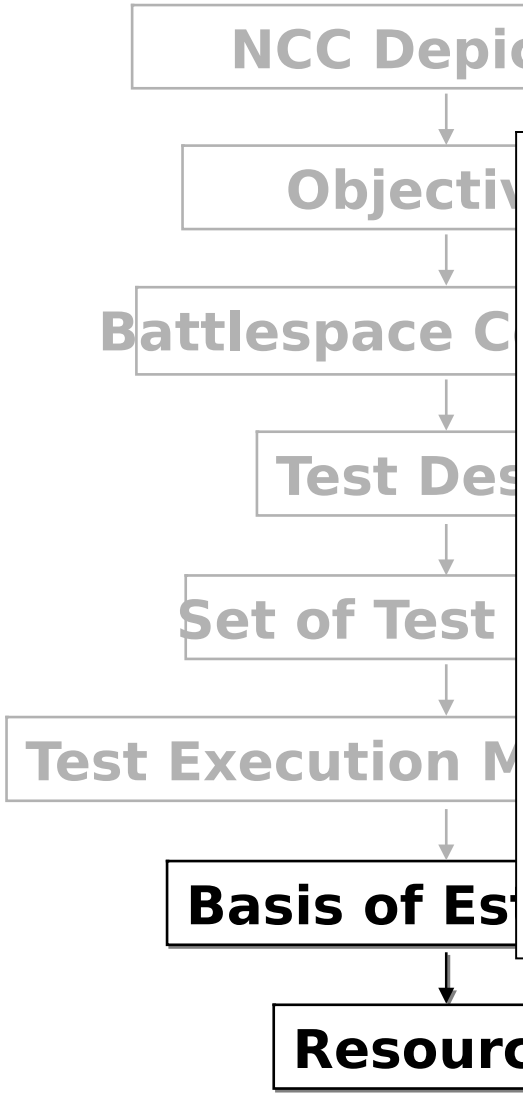
3 x 3 x 2 = 18 events

Major Test Events


Pre-deployment
Deployment
CSAR
S/E
Pre-deployment test events (Qualify/Support Forces)
Training material (data gathered during Type 1 training)
Analyze supply (provisioning based on projections)
Pack, transport, and set-up for operations (3 demos)
85 field events under varying conditions (3 sites)
Each event takes a half day
Maintenance

- 12 Test Events; analyze routine and surge ops by failure and fix rates supporting routine ops and mission planning
- Excursions:
  - Uniform Cold WX and MOPP operations

Basis of Estimate & Identifying Resources



- **Rationale to:**
  - **Estimate resources**
  - **Ensure adequate test & technical sufficiency**
- **Resources needed for OT Activities**
  - **Cost drivers**
    - **Range Time/M&S/Contractor Support**
  - **Long-lead items**
  - **Special efforts (e.g. M&S)**
  - **Not just AFOTEC resources**

Identifying Resources

Test Team	6 Personnel (data collectors, analyst/engineer, TD, logistician, etc.)
CSARL HHP/MPC	110/11
Comm Equipment	33 Motorola SecureCom SE
Forces	A-10, HC-130, MH-53, HH-60
Survivor / Evaders	B-52 Pilot, F-16 Pilot, Para-rescue
Ranges	Ft Sumner, Ft Huachuca, Guam, Ramstein AB
TDY	Ft Sumner, Anderson AB, Ramstein AB, Langley AFB
Vehicles	12 &15 Pack Vans, 2 Minivans

Summary

- **Early resource estimation for testing requires**
  - **Understanding of the battlespace**
  - **Understanding desired requirements or capabilities**
  - **Development of Battlespace Conditions**
  - **Initial test design**
- **Necessary Conditions Chart provides structured foundation**
- **Results = better estimates of resources required for future tests**